

QCT BMD measurement can be achieved with the routine CT scans, it is particular important for the hip and spine fractures, the vBMD results can be used to diagnose osteoporosis and useful in the pre-op planning.

#### Brief CV

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Research Area(s): Radiology, bone density measurement

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#### TRABECULAR BONE SCORE PREDICTS FRACTURE INCIDENCE IN NON-OSTEOPOROTIC OLDER CHINESE MEN

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Background: Trabecular bone score (TBS) based on secondary analysis of pixel gray-level variations in DXA images of the lumbar spine is an indirect novel surrogate marker of global bone microarchitecture. There are cross sectional and prospective data to suggest that TBS is independently associated with fracture. There is however a lack of prospective data to confirm its role in fracture prediction in Chinese population and whether such role remains in non-osteoporotic subjects.

Subject and method: 2000 men and 2000 women aged 65 years or more were recruited in 2001–3 for predictors of osteoporotic fractures. At baseline, comprehensive health assessment was performed. Bone mineral density (BMD) of hip and spine was measured by Hologic dual energy X-ray absorptiometry. All subjects were followed up for an average of ten years for incidence of fractures primarily by electronic medical record system of the public hospitals in Hong Kong. Cox regression was performed to examine the association between baseline TBS scores (as assessed by TBS iNsite, Medimaps SA) and the incidence of major osteoporotic fractures over ten years. Femoral neck BMD was used as covariate. The subjects with osteoporosis as defined by T-score  $\leq -2.5$  at either hip or spine were excluded from analysis.

Result: 1665 men and 1071 women had BMD within the normal and osteopenia range at baseline. Out of these, 91 men and 91 women had major osteoporotic fractures over ten years. Out of these 41 men and 19 women had hip fractures. Cox regression after adjustment for hip BMD and age showed that TBS score was significantly associated with major osteoporotic fracture in older men, but not in women ( $p = 0.025$  and  $0.112$  in men and women respectively). In contrast, TBS predicted hip fracture in older women but not in older men ( $p = 0.048$  and  $0.393$  respectively). Similar results were obtained when FRAX score was used as covariate.

Conclusion: TBS of lumbar spine was predictive of major osteoporotic fracture in older Chinese men without osteoporosis independently of clinical risk factors and hip BMD. The role of TBS in predicting osteoporotic fractures in non-osteoporotic older women requires a larger study.

#### Brief CV

##### Appointments

1.8.06 — Professor II in Medicine/Geriatric Medicine Prince of Wales/Shatin Hospitals, Shatin, Hong Kong

1.7.04 Director of Jockey Club Centre of Positive Ageing

2010 Director of CUHK Jockey Club Centre for osteoporosis care and control

#### Representative publications (total number of publications: 168)

Kwok T, Leung J, Zhang YF, Bauer D, Ensrud KE, Barrett-Connor E, Leung PC for the Osteoporotic Fractures in Men (MrOS) Research Group. (2012) Does use of ACE inhibitors or angiotensin receptor blockers affect bone loss in older men? *International Journal of osteoporosis* 23(8):2159–67

Kwok T, Khoo CC, Leung J, Kwok A, Qin L, Woo J, Leung PC. (2012) Predictive values of calcaneal quantitative ultrasound for non-vertebral fracture in elderly men: results from the MrOS study (Hong Kong). *Osteoporosis international* 23(3):1001–6

Woo J, Kwok T, Leung JC, Ohlsson C, Vandenput L, Leung PC. (2012) Sex steroids and bone health in older Chinese men. *Osteoporosis International* 23(5):1553–62

Griffith JF, Yeung DKW, Leung JCS, Kwok TCY, Leung PC. (2011) Prediction of bone loss in elderly female subjects by MR perfusion imaging and spectroscopy. *Eur Radiol* 21(6):1160–9

Yuen KWK, Kwok TCY, Qin L, Leung JCS, Chan DCC, Kwok AWL, Woo J, Leung PC. (2010) Characteristics of age-related changes in bone compared between male and female reference population — a pQCT study. *Journal of Bone and Mineral Metabolism* 28(6):672–81

Kwok T, Ohlsson C, Vandenput L, Tang N, Zhang YF, Tomlinson B, Leung PC. 2010 ACE inhibitor use was associated with lower serum dehydroepiandrosterone concentrations in older men. *Clinica Chimica Acta* 411:1122–1125

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#### HIGH-THROUGHPUT CELL IMAGING IN BONE SYSTEMS BIOLOGY

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Cyclic mechanical loading is perhaps the most important physiological factor regulating bone mass and shape in a way which balances optimal strength with minimal weight. This bone adaptation process spans multiple length and time scales. Forces resulting from physiological exercise at the organ scale are sensed at the cellular scale by osteocytes, which reside inside the bone matrix. Via biochemical pathways, osteocytes orchestrate the local remodeling action of osteoblasts (bone formation) and osteoclasts (bone resorption). Together these local adaptive remodeling activities sum up to strengthen bone globally at the organ scale. To resolve the underlying mechanisms it is required to identify and quantify both cause and effect across the different scales. Progress has been made at the different scales experimentally. Computational models of bone adaptation have been developed to piece together various experimental observations at the different scales into coherent and plausible mechanisms. However additional quantitative experimental validation is still required, especially on the cellular level, to build upon the insights which have already been achieved. A systems biology approach to understanding biological systems demands the development of high-throughput imaging methods which are capable of yielding spatiotemporal information at single cell resolution. Given the diverse micro-mechanical environment which exists in loaded trabecular bone, the availability of such data for osteocytes would undoubtedly enhance our understanding of their role in bone remodelling. As part of this presentation, emerging as well as state-of-the-art techniques of high-throughput imaging will be discussed and how these techniques might be used in a systems biology approach to further our understanding of the mechanisms governing load induced bone adaptation, i.e. ways will be outlined in which imaging and computational approaches could be coupled, in a quantitative manner to create more reliable multiscale models of bone.